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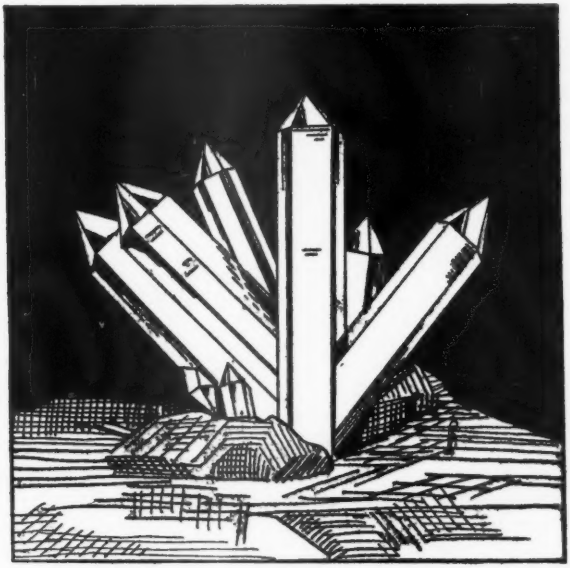
VOL. 11, NO. 8 WHOLE NO. 62

ROCKS AND MINERALS

A Magazine For Mineralogist, Geologist & Collector



OFFICIAL JOURNAL OF

THE ROCKS AND MINERALS ASSOCIATION

PUBLISHED MONTHLY AUGUST, 1936

THE BULLETIN BOARD

Helping the Hobby

By

E. A. SOUTHWICK

Collectors of rocks and minerals are fully cognizant of the fact that their hobby is one of the most interesting and beneficial that can be followed. They realize that there is ample justification for many others to become interested in this fascinating pursuit, and they should be awake to every opportunity to spread the propaganda of our happy cult.

The best way to do this on a large scale is through the printed word. Admittedly, the magazine covering this subject is in position to do the most effective work. We can't all be magazine editors, so our next best procedure is to boost our favorite magazine that caters to collectors of rocks and minerals, thus helping such publication to render the best of service.

We can do this in various ways, of course, but there is one method in particular that should be taken advantage of by collectors, whereby they can render effective aid to the cause they represent, also to the magazine, and without, as a rule, any cost to themselves. In fact, they may even make it a profitable work.

Many collectors, especially in the mineral localities, have numerous duplicates and surplus material which they do not need or want, and which, as long as they hold, does nobody any good. At the same time there may be many who are looking for just such material, or who at least do not have it in their cabinets, and who would be interested in any offer that would enable them to obtain it.

Dealers also frequently find it difficult to get stock and would welcome any offers of material that would enable them to increase the variety or better the quality of their offerings. Of course, they must have it at a wholesale rate to enable them to make a profit, but this will be compensated for in the fact that they will buy larger quantities than will the collector.

Let all collectors advertise their duplicates for sale and they will have more money to spend on their hobby, we will have an extra good magazine and this in turn will be instrumental in bringing many new collectors into the fold.

It only takes a few words in a classified advertisement to describe and price some nice surplus material which we may possess, and the cost is low. Every little ad. is a boost in the right direction. Help yourself, help ROCKS and MINERALS, help to start new collectors and encourage old ones. Do this and our hobby will thrive.

Attention, Members!

The Rocks and Minerals Association has received the following invitation from Mr. David Rosendale, President of the Colorado Mountain Club:

"Members of the Rocks and Minerals Association will be welcome on Colorado Mountain Club trips."

We are grateful to Mr. Rosendale for his very cordial invitation and feel sure that many members will show their appreciation by taking in some of the interesting trips scheduled by the Club.

Schedules of these trips are available from the Colorado Mountain Club, 422 Chamber of Commerce Bldg., Denver, Colo.

The Association is indebted to its Vice-President, Mr. Ronald L. Ives, for the invitation.

ROCKS and MINERALS

A MAGAZINE FOR MINERALOGIST, GEOLOGIST AND COLLECTOR

PUBLISHED MONTHLY --- FOUNDED 1926

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Edited and Published by Peter Zodac

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WHOLE No. 62

METEOR CRATER

By

GEORGE M. COLVOCORESSES

Meteor Crater is an irregular mound with a maximum elevation of 160 feet rising from an otherwise nearly level plateau, which is 5700 feet above sea level and composed of sedimentary rocks; sandstone, and limestone laid down in the Carboniferous Era when this part of America was submerged under an arm of the Pacific Ocean. It is located in northern Arizona twenty miles west of Winslow and forty miles east of Flagstaff. Once this hill is climbed one stands on the rim of an immense circular bowl with the upper portion of the inner walls nearly vertical, then sloping gradually to the level bottom about 1000 feet in diameter with a floor of sand covered by a growth of desert shrubs and grass. The top diameter of the bowl is slightly over 4000 feet and the maximum depth 600 feet.

To some visitors Meteor Crater is just a big hole in the ground, to others it is one of the most remarkable manifestations of natural forces that exist on the surface of the globe, and the great Swedish scientist, Arrhenius, once referred to it as "the most interesting spot on earth."

The Crater was long known to the Navajo Indians. They blamed its existence on a wicked god, who, like Satan, was cast out from the Indian Heaven and fell in flames to the earth, digging this pit and burying himself there.

Around 1860 the United States Army scouts referred to the Crater as "Franklin's Hole" and later it was mapped as Coon Butte. In 1886 Mexican sheep herders picked up a number of the iron fragments which eventually were sent East and examined by the late Dr. A. E. Foote, of Philadelphia, who recognized them as meteorites and after visiting the locality in 1889 suggested that a falling cluster of such fragments was responsible for the Crater. Ever since then the origin of the Crater has been the subject of much heated discussion, some maintaining that it was the result of a steam explosion; others that it was the vent of an extinct volcano (although there are no volcanic rocks within a distance of twelve miles) and still others that it was a sink-hole, in spite of the uplifted rim and debris which could only have been thrown out from below.

The Meteorite impact theory, first thoroughly developed and confirmed by the late D. M. Barringer, is now accepted by nearly all qualified investigators and has led to the conclusion that several million tons of meteoric iron should lie buried in the vicinity of the Crater and since this has a commercial value of close to $50.00 per ton in nickel and the platinum metals it was hoped that it might constitute a very valuable ore body. For the last thirty-five years serious efforts

have been made at intervals to find, develop, and exploit this ore, but although the mass, or at least a portion of it, has been pretty definitely located by geophysical survey and drill holes and indications favor a sufficient tonnage to form the basis for a very profitable mining operation, yet the character of the rock in which it lies and the immense quanity of water trapped in the shattered area has made exploration so expensive that each attempt to actually reach the meteorite has been abandoned without definite results and work has been at a standstill since the present depression put a damper on all ventures of this nature.

A so-called "shooting star" when in the air is a meteor; if it survives the fall and lands on earth it is termed a meteorite. Comets are composed of a cluster of particles of matter which form the nucleus or head, usually surrounded by a gaseous atmosphere called the coma and followed by a stream of gas often millions of miles in length, known as the tail. There are several well-known comets which follow fixed paths in the heavens and become visible at fixed intervals of several years; others have not returned to keep their appointment and must either have been deflected from their regular orbits or torn apart by approaching too near to other heavenly bodies. Such destruction of comets has actually been observed and fragments of these may become meteors. Comets, like planets, shine with the reflected light of the sun, but they also have some inherent light perhaps due to electric or radio activity.

No one knows the origin of the comets; they are generally supposed to be fragments cast off from our sun or other stars, wandering about in space for long periods of time and covering great distances at enormous rates of speed. The known comets now seem to trail along as outriders to the solar system and are comparatively few, but the quantity of meteors is incalculable. It has been estimated that some twenty million visible meteors enter our atmosphere every day and recent observations of Admiral Byrd's expedition to the Antarctic tend to greatly increase this number. Most of them glow from the time that they are about 80 miles above the earth until they have fallen to a height of some thirty miles. Usually these are no bigger than a walnut, although appearing much larger, and fortunately nearly all burn up well above us so that only about nine hundred larger meteorites fall to earth each year and three-fourths of those should strike in the oceans.

The majority of meteorites are composed of rock similar to the igneous rocks of this planet, they are known as aerolites and tend to decompose rapidly while the other type, siderites, are a natural alloy of nickel and iron and practically indestructible. Meteorites have a peculiar interest because they serve to establish our only tangible contact with any heavenly body; they can be handled, weighed and analyzed in a laboratory, and while I believe that no elements unknown on the earth have yet been found, they contain a number of combinations of elements which do not occur in terrestrial minerals.

Now the Barringer Meteorite which formed Meteor Crater being really the head of a small comet, was a compact swarm or cluster which may be compared to the charge of shot in a gun cartridge.

If the Barringer Meteorite came from the sun, it may have been torn off at the same time as the earth and other planets some two billion years ago, by the impact or approach of a colliding star, or it may have been blown out by some later explosion of sun-gas, but its origin and age we are never likely to know. Chances are that it wandered about for many million years until finally it approached too close to the earth, whose gravity overcame the attraction of the sun and moon and so it plunged down into our atmosphere and then into the earth itself. The total mass of this meteorite has been variously estimated at from less than one-half million to more than thirty million tons, but it is very unlikely that there were any large single pieces for of the many thousand fragments which have been discovered the largest weighs only 1,400 pounds, while over 99 per cent of them are smaller than a baseball.

Imagine then, for, based on present knowledge, this is the best picture we

can construct: A dense cluster of iron fragments some four hundred feet in diameter; the outside at white heat from friction with the air, but the great bulk cold as outer space, flashing down through the atmosphere with a speed of several miles per second, striking the surface sandstone, penetrating on an inclined path through half a mile of solid rock, and finally coming to rest below the huge crater which it had formed. The horizontal rocks were tilted upwards around the rim of this crater, just as soft mud is tilted up around the edges of a hole into which a stone has been thrown with force. Immense heat was generated by the friction of the meteorite passing through the rocks, so that in places the silica was fused until it resembles the fulgerite glass which is produced when lightning strikes a sandbank or converted into the porous stone known as La Chatellierite. Some of the sandstone was crushed to an impalpable powder, each individual grain being pulverized and shredded as could only be done artificially with the blow of a heavy hammer, while shock waves shattered the rock structure through a large area which was not exposed directly to the blow. Super-heated steam was generated from the moisture in the rock and this steam, together with the tremendously compressed air, which had been forced ahead of the meteorite like a gun-wad, blew back out of the hole and between the force of the impact itself and the outrush of the air and steam many huge boulders, countless small fragmens of rock and quantities of sand were ejected and fell back some portion into the Crater and the balance around the rim or scattered over the outlying plain. The completely pulverized rock dust or flour must have been blown to a height of many miles and drifted over the earth, as did the dust from the explosion of Krakatoa near the Island of Java, which clouded the atmosphere for several weeks in 1883.

As one scientist has expressed it, "When the meteorite fell the earth shook" and that we may well believe, for the fall of a much smaller meteorite in Siberia in 1908 was recorded on seismographs as far as eight thousand miles away, but on this previous occasion some 40,000 to 50,000 years gone by there were no seismographs and the earthquake-like tremor that must have accompanied the fall could have meant nothing beyond a temporary fright to the primitive representatives of the human race.

And thus, between the tilting upwards of the shattered rocks and the falling of the ejecta a mound was formed around the central bowl, and since then there has been the usual erosion from rain and wind gradually leveling off the outer edges, stringing out the sand across the plain in great bands, forming a talus within the Crater and filling in part of the central basin which is now dry, although for many years it harbored a shallow lake, and successive layers of sand and recent marine organisms form the upper strata of this basin floor in which is found a layer of volcanic ash attributed to the last eruption of the San Francisco Peaks, some forty miles to the west.

Around the edges of this bowl, and mixed with the ejected rock and sand have been found a great number of iron meteorites and specimens are preserved in nearly every museum, often miscalled "Canyon Diablo Meteorites," for Canyon Diablo is two miles distant from the Crater and is merely an ordinary erosion canyon. These meteorites we believe to have been outlying fragments of the main cluster, stripped off by friction of the atmosphere during its flight to earth. Altogether many thousand fragments were picked up from the surface or dug from shallow trenches and recently a number have been located with the aid of radio detectors. The great majority were located close to the rim but some were found with decreasing frequency to a distance as great as three or four miles away.

Analyses show that they are typical siderites, essentially an alloy of some 90 per cent iron and 6 per cent to 9 per cent nickel and they assay about 0.2 oz. platinum, 0.1 oz. iridium per ton with small quantities of other metals. When these fragments are cut and a polished surface is etched with acid, they show the so-called "Widmanstatten figures" which form a pattern of parallel lines crossing others in three ways at right angles and are a definite characteristic of many meteor-

ites. These figures are not found within an inch from the surface, proving that this outer portion only had been heated by friction to a temperature of more than 800 degrees Centigrade.

The meteoric iron is not very hard; it can usually be scratched with a knife or flattened with a hammer, but it is very tough and tiny diamonds or crystals of carbon occur in spots. Some pieces contain a substantial amount of free chlorine, causing them to rust and finally disintegrate into a powder of brown iron oxide and Mr. Barringer believed that this was responsible for the ever-present "thumb pits" and also that all or many of the solid irons were cores of the original units of the cluster, surrounded by layers of softer oxidisable material which he termed "shale-balls."

Science has much to learn from a complete exploration of Meteor Crater for many scientists believe that meteoric iron is similar to the mass which composes the core of the earth and that after our planet separated from the sun it was gradually built up to its present size by collecting a great number of meteorites, comets, and asteroids which plunged into the gaseous or plastic sphere to be absorbed in its mass. The Barringer Meteorite was among the very latest comers of its kind and by far the largest one of which any trace is now preserved.

Support of this theory is found by some in a study of the moon, whose surface is pitted with some 30,000 craters, the larger ones visible through a small telescope. It has been generally supposed that these moon craters are of volcanic origin, but a number of astronomers now assign many of them to the impact of comets or meteorites and emphasize points of resemblance between them and Meteor Crater. Since the moon has had no atmosphere for countless ages there is no water, wind, rain or snow and therefore a hole made in its surface is a permanent record, whereas on the earth some few hundred thousand years serve to erase it entirely.

There are other but much smaller craters formed by meteorites still visible on the surface of the globe, notably in Texas, Mexico, Australia, Arabia and the Sahara Desert. The so-called "Bays" along the Carolina coast are believed by some to have been ploughed out by a cluster of meteorites which struck at a comparatively flat angle. The meteorite which fell in Siberia in 1908, unlike the Barringer meteorite, burst in the atmosphere and formed a number of small craters within a radius of some two or three miles. It killed an entire herd of reindeer and destroyed a forest to a distance of thirty miles, while the shock was felt and heard two hundred miles distant.

Meteorites have been found buried in craters which they had formed; one with a weight of 500 pounds was seen to fall in Hungary and promptly dug up from a grave about eleven feet deep. The largest mass in captivity (weight thirty-seven tons) was brought to the Museum of Natural History in New York by Admiral Peary. It was found on an island near Cape York, Greenland, and is believed to have originally fallen on a glacier and been carried along to the point where it was deposited. A 27 ton meteorite can be visited at Bacubirito, Mexico, and one with an estimated weight of sixty tons has been disintered at Hoba in South Africa.

It is evident that the initial speed of these meteorites had been greatly retarded by air resistance during their passage through the atmosphere so that they struck the earth with very little penetrating power, like a spent canonball, whereas the Barringer meteorite, with a mass of several million tons, probably lost a much smaller per cent of its original velocity and momentum.

The peculiar shapes and appearance of iron meteorites with their thumbmarks or pits has always made them objects of curiosity and often of veneration; it is said that the statue of Diana at Ephesus was a meteorite, although I cannot understand how any meteorite could resemble the beautiful Diana. The black stone in the Kaaba at Mecca, sacred to the Mohammedans, is an ordinary siderite and one of the depressions shaped somewhat like the print of a horse's hoof was traditionally made by the steed mounted by Mohammed when he took off for heaven.

A meteorite which was actually seen to fall in 1492 greately excited King

Maxmillian and by his order was long preserved in a church in Alsace.

Recently a professor of the University of California claims to have found living bacteria and organic nitrogen in stony meteorites after taking every possible precaution to destroy any earthly bacteria which might have been introduced after the fall.

This gentleman agrees that it would be quite inconceivable that any living organisms should be found in iron meteorites but if such should be definitely proved to exist in any type of meteorite at the time of their fall it would strengthen the theory that life on this planet was first brought from some other world. Of course, the mystery of life itself would be just as great whether it originated here or on Mars or on some planet of Sirius, but it would be marvelous to know that any living thing could actually survive a journey of billions of miles and perhaps millions of years at a temperature close to absolute zero. Such knowledge would alter our theories as to the origin of meteors and comets, leading us to believe that they represent the shattered remnants of planets, for no life could exist in the intense heat of the sun or stars and it would be fascinating to speculate that perhaps some day fragments of our own earth might wander off into space carrying life to far distant and unborn worlds and forming Craters not unlike the one which I have described. ?

Recent Finds of Interest

Prase Opal in California

Recently Mr. C. Cicero of San Francisco, while working his Chrome Mine near Knoxville, Napa County, California, noticed a turquorise green stone outcropping from a small vein about a foot in width. Not knowing what it was he took it to a friend who told him that it was Prase Opal, and sent him to the State Division of Mines where it was further tested and the former opinion confirmed, and added that it was of excellent quality and suitable for cutting and polishing, etc. A few Cabochon stones were immediately cut, polished, and added to the State gem collection. Mr. Cicero was advised to further explore the vein deeper to determine whether the quality held. At a depth of a few feet he found the same compact quality, but a darker and richer green color. Unlike most Opal this material seemed at all depths to be free of fractures. The material nearer the surface is lighter and somewhat milky. The darker material is quite clear. Under the microscope it has a slightly lower index of refraction than 1.45, isotropic, and the color element is in suspension. After it is cut and polished it very much resembles Chrysoprase, some being, as stated, a little darker in color. But being Opal is not as durable as Chrysoprase, and like all Opal is liable to fracture on very little heat being applied to the stone. Therefore care should be taken when cementing or removing it from the lap stick. Mr. Cicero, with other mining ventures to attend to, has prevailed upon Mr. Wilfred C. Eyles of San Francisco to market this new find for him.

Stibnite Inclusions in Rock Crystal in Nevada

Mr. Frank L. Garaventa, 744 Spokane St., Reno, Nevada, recently discovered near his city some unusually fine specimens of stibnite needles in rock crystal. Several hundred specimens ranging in size from 1"x¼" to 4"x1¼" have so far been collected. This is believed to be the first known occurrence of stibnite inclusions in rock crystal in the United States and perhaps the second known in the world as exhaustive search credits only one country, Japan, with an occurrence.

Mr. Garaventa, a member of the Rocks and Minerals Association, has promised to prepare an article on the occurrence as a contribution to our Symposium on Quartz and it will appear in a future issue of ROCKS and MINERALS.

The Search for Sapphires

By

JOSEPH W. HOWARD

Professor of Chemistry, Montana State University

The desire for gems, like the hunger for gold, has always led men to search the far corners of the earth. This is especially true of sapphires, which are being mined in Burma, Queensland, New South Wales, Ceylon, Siam and Montana. Not only are many of these locations at great distances from each other, but the methods used to remove the sapphires from their hiding places are equally divergent.

One of the most famous sapphire deposits of the world is in the Yogo Gulch of the Judith Basin in Montana. This deposit is in the form of a dyke of trap rock, outcropping through limestone. The dyke is at least a mile and a half long and two hundred and fifty feet deep. Its top is easily recognized since it makes a grass covered depression in its barren surroundings. According to early settlers in this district, the hated gopher and the lowly badger were the first prospectors to discover that this dyke contained sapphires. Finding it easier to dig into than the limestone on either side of it they selected "home sites" and went to work. The sapphires being hard and sharp were thrown out with the excavation material. Strolling ranchers often picked up the stones thus exposed, admired their beautiful blue tints, but never suspected their value.

Later four old time placer miners formed a company for the purpose of carrying on gold mining in this gulch. They spent some $40,000 to bring in an adequate water supply only to find that there was not enough gold to pay for further working. Before deserting their claims they decided to satisfy their curiosity as to the nature of the blue stones they had been discarding with the gravel. Their subsequent identification as sapphires of high grade changed an enterprise which seemed to have culminated in an absolute loss into a very profitable industry. This mine has already produced over $3,000,000 in sapphires and is far from exhausted.

These sapphires are mined by driving a direct shaft down through the dyke and running side tunnels from this at convenient levels. On bringing the ore to the surface it is piled in heaps for exposure to the action of the atmosphere. After weathering, a stream of water is turned against the side of the dump and the ore is washed into sluice boxes, where the sapphires and other heavy minerals are caught by the riffles. Coarser tailings passing over the riffles are stopped by dams for further weathering and washing. Attempts to crush the ore have proven much less satisfactory than this weathering method. While mining is a year around occupation, the ore piles are washed only from May to November.

Several properties make the Yogo sapphires valuable and distinctive. They are of the most highly esteemed color in sapphires, the cornflower or royal blue. This color is evenly distributed throughout the stone, making it bright and effective by artificial light. The stones from the mine match easily and hence are commercially economical for the manufacturing jeweler to handle.

Sapphire deposits are also found at the Eldorado, Emerald, Gold and other bars on the Missouri river near Helena, Montana. The gravel-sapphire mixtures make layers ten to 50 feet thick which rest on slate and granite, thus forming bluffs extending fifty to one hundred and thirty feet above the river. Dr. Kunz on an early visit to one of these bars reported that he saw and measured a mastodon tusk three feet long embedded in the gravel-sapphire layer.

At present these bars are being worked chiefly for gold, with sapphires as a by-product.

On Cottonwood Creek near Deer Lodge and the west fork of Rock Creek near Philipsburg, Montana, sapphires are found in weathered material down by the stream. On Rock

Creek a fourteen mile flume brings water for hydraulic mining. A "giant" is turned on the deposit washing the material into sluice boxes. Large rocks are forked out at the head of the boxes. This makes a very picturesque scene and of striking resemblance to placer mining for gold. This deposit has been worked profitably for years.

The majority of the sapphires from the Missouri River and other Montana gravels are gray, yellow, green or red, with only a few of the blue variety for which Yogo is famous. The Yogo crystals are largely rhombohedral with basal plane more or less present. They seldom have prismatic or pyramidical faces. Those from the other Montana deposits are hexagonal and characterized by the presence of prismatic faces and a basal plane. Thus we have two distinct types of crystallization in the same mineral, from the same state, apparently produced under similar conditions in igneous rocks.

The chief Burmese sapphire mines are found in the so-called Mogok Stone Tract, an area covering 600 square miles. The sapphires here, like those in Ceylon, are found as pebbles or rolled crystals in alluvial deposits or mixed with garnet and other minerals in glacial deposits. Many of them have been located by the native prospector who pushes an iron rod down into the ground and twists it constantly while it is being pushed into the earth. At intervals the rod is lifted out and examined. Sharp scratches indicate that sapphire bearing sand has been reached.

The Burmese miner varies his attack so as to best meet the conditions under which the sapphire deposit can be most easily removed. He works by "twins," hmyaws" or "lus."

The term "twins" is applied to any boring, pit, or excavation which does not have a tailing channel. They consist of small round pits, the diameter of which is only of sufficient size to allow the miner to descend by placing his feet in niches cut in the sides. The depth of these twins is usually 20 to 40 feet, although some are 100 feet deep. After the gem bearing earth is reached, horizontal channels and galleries are dug in all directions from the pit. The dirt is raised to the surface by baskets on the ends of crude bamboo hoists. Due to the large amount of water in the valleys during the wet season, this method of mining is entirely a dry season operation.

The "hmyaws" consist of deep cuttings in gently sloping hillsides. A ditch is dug around the side of the hill to serve as a canal through which water can be brought down from the mountain streams. In this manner alluvial deposits are washed down into sluice boxes and settling basins.

"Lus" consists of deep underground excavations or shafts into hill sides occasionally several hundred feet in depth.

The Europeans use power mining methods in Burma. Pits are dug fifty feet deep by several hundred feet wide. The miners at the bottom of the pit dig away the gravel, transferring it to a water filled depression, from which it is sucked through an eight inch pipe and carried to the sluice boxes.

In all sapphire mining operations the material caught by the sluice boxes must be subjected to further purification. It is first passed through a series of graduated sieves to remove some of the foreign material.

Another scheme is to feed the mixture across some sort of a jigging table over which flows a counter current of water. Due to their greater specific gravity (3.9-4.1) the sapphires settle while the gravel is washed away.

A very ingenious method is to make use of static electricity. In an electrical field there is a force acting on the sapphire crystal moving it in the direction of the positive pole, while gravel is unaffected. Hence if a gravel-sapphire mixture is dropped through a tube containing such a field the sapphires are drawn to one side and separated from the gravel by a properly placed division in the bottom of the tube.

Final sorting and grading is a "hand picking" task and must be performed by experts.

Sapphire is a transparent variety of the mineral corundum. Chemically it is Aluminum Oxide colored by small amounts of other metal oxides. The oxide of chromium makes it red; of titanium, blue; of iron, yellow. Other colors are due to mixtures of these oxides. If none of these oxides are

present we have a clear colorless stone known as a white sapphire. The red sapphire is more commonly known as the ruby.

While color makes a great difference when sapphire is used as a gem, it is the hardness of this stone which makes it commercially valuable. This is 9 on Mohs scale, thus placing it between topaz and diamond.

One large electrical manufacturing firm uses more than a million and a half per year for bearings in meters and other electrical instruments. Many thousands are used annually for watch jewels. The wear resistant surface of the sapphire makes it valuable in wire drawing dies.

In the days when all gem stones were believed to have special charms, sapphires were considered emblematic of wisdom. If placed on the heart they bestowed strength and energy. They would even procure royal favors, free people from enchantment and obtain release from captivity. While no such claims are made in modern times their present uses may lead to equally desirable results.

Sites of Minerals, Mines and Quarries Found Within 50 Miles of Washington, D. C.

By

DR. TITUS ULKE

Strange as it may seem, Dana's Textbook of Mineralogy refers to the District of Columbia as a region very poor in minerals, and lists therein only a few as worth mentioning, namely, gold, yellow titanite, rutile, limonite, calcite and prochlorite.

In striking contrast with this statement, a careful study of the pertinent literature and local collections reveals that no less than 93 species and 45 distinctive varieties of minerals have actually been found in the District of Columbia and vicinity, that is, within a circle drawn about 50 miles from our nation's capitol.*

An imaginary line drawn from Baltimore, through Washington, to Fredericksburg, Va., would divide this area into approximately two equal halves, i. e. the Coastal Plain to the East, and the Piedmont Plateau to the West.

Each of these two regions, clearly separated by the fall line, are characterized by distinctive geographic features due to striking differences in their geologic origin and subsequent modification, the Coastal Plain being occupied by sedimentary formations consisting chiefly of unconsolidated gravels, sands, marls, loams and clays, while the geological formations of the Piedmont Plateau are practically confined to massive igneous and metamorphic rocks.

Similarly certain minerals are distinctive of each of the above physiographic regions, and are, in the main, confined to them.

The Coastal Plain here is characterized by the exclusive occurrence therein of vivianite, glauconite, selenite, lignite and marcasite, together with most of the kaolinite, opal, jasper, agate and iron ores, such as limonite, hematite, turgite, goethite, siderite, and magnetite, and the absence of the zeolites and most of the remaining minerals, except, as we find them, sporadically, in drift or gravels.

To the region of the Piedmont Plateau, on the other hand, are restricted the occurrences of our seven local representatives of the zeolite group, namely, analcite, datolite, chabazite, heulandite, natrolite, laumon-

*See Monograph in "Rocks and Minerals," Peekskill, N. Y., January, February and March, 1936, entitled "Minerals of the D. C. and vicinity, with pertinent Bibliography," by Titus Ulke.

tite and stilbite, the silicates epidote, prehnite, serpentine, talc, tourmaline, beryl, zoisite, axinite, and cyanite, as well as titanite and rutile; the minerals, *in situ*, of the following three groups, the feldspars, the pyroboles (pyroxene-amphiboles) and the micas, as well as all of the vein gold, copper, zinc, and chromium ores found in this region.

Iron Mines

Records show that up to some fifty years ago large deposits of iron ores, such as **hematite, limonite** and **siderite,** which occurred in bands and pockets in the Potomac formation of the Coastal Plain, as for example, near Branchville and Muirkirk, Md., were smelted at Muirkirk into pigiron. Most of these old open cut workings are now filled with water. In the Piedmont Region bodies of hematite were formally mined in Maryland at the Springfield and Carroll mines near Sykesville, at the Mineral Hill Mine near Louisville, and at the Patapsco mine near Finksburg. **Magnetite** was mined at a locality one mile southeast and two and one-half miles northeast of Whitehill in Baltimore County, Md.

Chromium Mines:

Formerly large bodies of chormite ore were profitably mined in several localities northeast of Baltimore, such as at Bare Hills and Soldier's Delight. Chromium ores may be traced in Maryland along a serpentine rock belt extending from near New Lisbon, Carroll County, through Montgomery County, nearly to the Potamac River a few miles above Seneca.

Zinc Mines:

Zinc ores (calamine with sphalerite and smithsonite) were formerly mined near New Windsor, Carroll County, Maryland.

Copper Mines:

Local accumulations of **native copper** found peppering epidote-bearing eruptives and often associated with calcite, cuprite, malachite and other copper-bearing minerals, have been sporadically worked in a few localities in the Blue Ridge and Catoctin Mountains, as in Frederick County, Md., and in the foothills of Virginia.

Sulphide ores of copper, such as copper glance, chalcopyrite, and bornite, occurring massive or disseminated together with magnetite, carrollite, malachite and a little native copper and gold, were extensively mined many years ago at Mineral Hill, in Carroll County, Md. Copper glance was also taken out at the Bare Hills and Dolly Hyde Mines of Carroll County, and the Liberty Mine and Roop Farm of Frederick County, all in Maryland.

Gold Mines:

Native gold, as well as a low-grade auriferous pyrite, occurring in quartzitic seams and iron-stained gash veins in decomposing schist and gneiss, have been mined at the Maryland, Potomac, Kirk, Ford and Huddleston Mines in the neighborhood of Great Falls and Bethesda, Md., and in numerous other localities extending in a belt in the Archean Rocks along the Blue Ridges of both Maryland and Virginia. It is reported that gold to the value of $30,000 was taken out at the Maryland Mine alone. In view of the present enhanced price of gold a number of these old low-grade mines are being opened up again. Near Fredericksburg, Va., and along the Rapidan River, several gold prospects and mines, at least one provided with a modern oil flotation plant, were in operation last year.

Some alluvial gold, in the form of small nuggets and grains, has been obtained by sluicing the gravels and stream sands occurring in the valleys of the nearby upper Potomac River, in Virginia as well as Maryland.

Pyrite Mines:

Massive bodies of iron pyrite, with some admixed chalcopyrite, occurring in a diabasic country rock, were mined, until recently, a few miles north of Dumfries, Va., and shipped to sulphuric acid manufacturing plants.

Mica, Beryl and Feldspar Mines:

Pegmatite dykes, carrying sheets of mica and massive orthoclase feldspar, and occasionally large crystals of yellowish beryl, were formerly worked at a number of localities in Maryland, notably near Kensington, Scaggsville and Burtonville, and along the Patuxent River. Microcline feldspar was mined near Woodstock, Granite, and Hollofield in Baltimore County and at a place four miles west of Laurel, Md.

Rock Quarries:

Serpentine and **soapstone** were formerly quarried at a locality one and one-half miles west of Bethesda, Md., and in early days by Indians in the District along Connecticut Avenue near Albemarle Street, as well as near Ammendale and Langley, Va., where the soapstone is usually found in lenses in altered diorite and gabbro rock. Serpentine was once quarried also at Bare Hills and Reistertown in Maryland, in Baltimore County.

Bluestone (granite-gneiss) is now largely quarried for building stone along the Potomac River below Chain Bridge, Va., and in the Piedmont Hills of Maryland and Virginia. Formerly **granite** was also quarried near Cabin John(Gilbert Quarry) and Garrett Park (Riggs Quarry).

Traprock (diorite) is taken out for road material at several places along Goose Creek, Va.

Limestone and **dolomite** were formerly, and to some extent are still quarried in Maryland (Baltimore and Frederick Counties) and in Virginia. **Brecciated Marble** may be obtained at Point of Rocks, Md.

Red sandstone of the Triassic age, was extensively quarried many years ago not far from Seneca, Maryland. The old Smithsonian building and Cabin John Bridge were built of this material. It was also used in the construction of the old Potomac Canal locks at Great Falls, Va., and in building aqueducts along the Chesapeake and Ohio Canals.

That many extensive accumulations of **marl, clay, gravel, sand,** and **diatomaceous earth** have been found either in the District or within forty miles thereof should at least be mentioned. **Glauconitic marl** is dug for fertilizer in Maryland (Prince George County) **clay** for making bricks and terra cotta in Virginia, as near Alexandria, in the District, as near Terra Cotta, and in nearby Maryland, while **diatomaceous sand** for making insulating compounds and silica-brick was formerly taken out extensively along the Patuxent River (Lyons Wharf) and Chesapeake Bay (Herring Cove and Plum Point).

A large crystal of Topaz from Marambaia, Brazil. Weight 99½ pounds.

(Field Museum of Natural History, Chicago)

Some Notes On Fluorescence

DR. J. C. MEYERS, Berkeley, Calif.

It has been my good fortune to have been a student of mineralogy in my early life and later to have devoted my time to research in the scientific field with The Pacific Scientific Laboratories in Oakland and Los Angeles, California. In this connection I have made a rather exhaustive study of ultra violet light and its effects in the determination of what is called group fluorescence of crude oils, that is in being able to determine the exact sand from which the oil is being pumped by the color which is shown by its fluorescence. This in itself seems to indicate that the oil from the same sand depths was laid down in the same geological period. Some very good work has been done in this connection by Mr. John Melhase of Berkeley, Calif., and I have heard him give a most interesting talk before the Mineralogical Society of Southern California, demonstrating the effects by using a cold type, argon mercury quartz light for the purpose.

It is a well known fact that when mercury vapor is subjected to an electrical discharge in a vacuum tube of quartz, ultra violet light is emitted. The tube must be tilted to strike an arc but on account of the quantity of current necessary to maintain the arc a great amount of heat is generated and the light emitted is very high in visible light and if fluorescence is wanted an expensive filter must be employed. This type of light is known as a "hot quartz light."

In a 'cold quartz light," argon gas plus a small amount of mercury, is used to carry the current through a vacuum tube of quartz and when this mixture is excited by an electrical current of rather high voltage but of low amperage, ultra violet light very rich in the shorter wave lengths and quite low in visible light, is emitted. This type of light gives off very little heat compared with the one which uses mercury alone and is the type most desirable for fluorescence.

In the cold quartz lamp put out by the R & M Manufacturing Co., of 16 S. Raymond, Pasadena, Calif., a very small amount of another gas (manufacturing secret) is added to the argon and mercury which tends to increase the amount of ultra violet light. The addition of the new gas increases the temperature to a moderate extent but the excess heat is easily carried off by the metal shield surrounding the light. The combination as worked out produces a wonderful source of ultra violet light. The quartz vacuum tube used by the company contains a small amount of nickel oxide which was employed in the fusing of quartz so that it could be worked more easily. Sometimes tiny beads of mercury are to be seen in the quartz tube. These are simply surplus mercury.

As I have retired from active service, I now have the opportunity of spending a good bit of my time in collecting showy minerals and fluorescent materials. Recently I spent some time near Paterson, N. J. and around Franklin, N. J., and did some very fascinating night prospecting with my R & M cold quartz lamp which was converted to dry cell operation. Some very interesting specimens were thus secured. Through the courtesy of the New Jersey Zinc Co., I was permitted to go through a section of their mines at Franklin and my lamp revealed most gorgeous fluorescent minerals. Some of these fluorescent minerals are now becoming quite scarce.

On my return trip, I visited all the best known mineral localities in North Carolina, Texas, Missouri and Kansas and have collected such a showy lot of fluorescent and other minerals as to make me feel very proud of them.

The New Jersey minerals in my fluorescent collection are by far the most beautiful. The case is illuminated by an R & M cabinet type lamp which works in an undarkened room without a filter. Two other types of lamps were discarded in favor of this one.

A large amount of time and money has been saved in the mining and milling of scheelite (tungsten ore) by illuminating the handling of unnecessary waste material, using cold quartz lamps in the sorting. Low grade mercury bearing ore is easily determined with these lamps by the most simple method. A large field is open to those interested in research with ultra violet light.

Two Occurrences of Babingtonite in Massachusetts

By

JOHN E. KITSON

Babingtonite, a vitreous greenish-black silicate, (Ca, Fe, Mn) SiO_3, was originally found in Spain by Dr. Wm. Babington who brought specimens to England where, after thorough examination, they were declared to be a new mineral by the British Royal Society. The new mineral was named babingtonite in honor of the discoverer.

Since that time, babingtonite has been found in various parts of the world, sparingly in several localities in Massachusetts, but never in large amounts, and he is a fortunate collector who has a good crystallized specimen in his collection.

In the spring of 1929, a blast at the Mt. Tom trap rock quarry, in Holyoke, Mass, exposed a fissure, or gash vein, extending upward 16 feet from the quarry floor which produced some of the largest and best crystals of babingtonite ever found. The crystals varied in size from minute to more than one-half inch in length. Unfortunately, most of the specimens went through the crusher before the quarry superintendent noted their unusual formation. He set some aside, giving them later to Dr. H. O. Hastings, curator of the nature museum of the Mt. Tom Summit House. The doctor showed the specimens to local authorities who carelessly classified the mineral as a black variety of epidote.

Some months later, Prof. George H. Barton of Cambridge, Mass., noted the attractive specimens on exhibition at the Summit House and requested one for Charles Palache, Professor of Mineralogy at Harvard University. Prof. Palache found it to be an unusually good specimen of babingtonite. A few days later, Prof. Palache and an associate, with Dr. Hastings, visited the locality and secured what was left of the occurrence—about a bushel—from which enough material was obtained for a more thorough examination to confirm beyond doubt previous examination. After the visit to the quarry, Dr. Hastings presented Prof. Palache with a specimen of unsurpassed size and beauty.

The specimens from this occurrence are unusually handsome because of the alternate layers of trap rock (base), white calcite, and green prehnite over which the black babingtonite crystals are thickly sprinkled. The writer has two small specimens on which one-fourth inch white chabazite crystals share honors with the black babingtonite crystals on a bed of light green prehnite.

During the summer of 1935, at the Notch quarry of the Mt. Holyoke range, in the township of Amherst, a party, of which the writer was one, discovered another occurrence of babingtonite with layers of calcite and prehnite but unfortunately, in this instance, the babingtonite is below the prehnite and calcite and consequently its crystals are crowded together and appear as a vitreous black streak in series with the white calcite and dark green prehnite. Handsome specimens all right but not so remarkable as the Mt. Tom occurrence. Because the Mt. Holyoke specimens were found in the center of the blast debris, it was not so easy to determine the nature of the occurrence but it is probably the infiltration fill of a very limited crushed zone.

Second Annual Trip of the Nevada Rocks and Minerals Study Club

The Nevada Rocks and Minerals Study Club took their annual trip on May 24, visiting the Castle Peak Quicksilver Mine and Virginia City. Twenty members went on the trip. The party started from Reno at 9 A. M., going first over the famous Geiger Grade to the Castle Peak Quicksilver Mine which is about eight miles north ot Virginia City.

The party made their first stop at a point on the Geiger Grade known as Dead Man's Curve. At this point a fine view could be obtained of the Sierra Nevada Mountains, for more than thirty miles, at the foot of which could be seen the famous Steamboat Springs.

The formation of the Sierra Nevada Mountains by block faulting was described by Professor Walter S. Palmer and it was pointed out how the deposits at Steamboat Springs were and are being formed by hot waters ascending in the fault fissures that had relationship to the faults that formed the mountain range to the west. These deposits at Steamboat are extremely interesting and are cited as an example of an ore deposit in process of formation. We find here deposits being formed that carry pyrite, stibnite, cinnabar, sulphur, siliceous sinter, calcite, and some gold and silver, all of which are being deposited at the present time. The Club is planning a trip to the springs this fall for a careful study of the deposits.

In passing it might be of interest to note that the old Geiger Grade, unchanged in location from its original location during the early Comstock days, is to be abandoned this year for a new road located a short distance to the north of the present road. The new road will be entirely a high gear road, eliminating the sharp curves and steep grades of the old road which only the best cars could navigate in second gear. In the early days, however, a locomotive was hauled by ox team over this Geiger Grade to Virginia City to enable the Virginia and Truckee Railroad, from Reno to Virginia City, to be built from both ends at the same time.

The party then passed on to the Castle Peak Quicksilver Mine. This deposit is different from the other deposits found in Nevada. It consists of an outrop of an altered andesite up to 80 feet wide. The mass of andesite contains many fractures and the entire mass is more or less mineralized. Mr. H. E. Loufek, Manager of the Castle Peak Co., who showed the party around stated that cinnabar can be panned from the surface dirt over a considerable area and some of this surface dirt would be workable ore with a little higher price for quicksilver.

The chief quicksilver mineral is cinnabar but there is also a very appreciable amount of native quicksilver in some of the ore. Native quicksilver is uncommon to the Nevada quicksilver ores. The party first visited large glory holes where considerable rich ore was found near the surface. The mine proper was entered through a tunnel about 1000 feet long, and the party was able to visit one of the large stopes from which the ore had been extracted.

The reduction plant was next visited. This is a modern plant equipped with crushers to reduce the ore to a maximum size of about one inch. It is then fed to a Gould rotary furnace. Here the ore is heated to redness and due to reaction with air the mercury sulphide is broken up, the sulphur combining with oxygen to form sulphur dioxide gas and at the heat of the furnace the mercury liberated is volatilized. The gases from the furnace pass next through cyclone dust collectors where the solids are removed and then to large eighteen inch cast iron inverted U-bends, about 20 feet high, set vertically, which act as condensers. Here the gases cool to the point where the quicksilver condenses and falls to a hopper at the bottom from which it is removed at intervals. The quicksilver after collecting is bottled for shipment in 76 pound lots in iron flasks.

Early in the afternoon the party moved on to Virginia City. The first stop was made on an old dump of the Ophir Mine where a good general view of the camp could be obtained. With

EDITOR'S NOTE—The Nevada Rocks and Minerals Study Club is affiliated with the Rocks and Minerals Association and the trip was held in conjunction with the Association's outing.

the aid of maps from Becker's Atlas of the Comstock the main points regarding the geology of the district were pointed out. It was noted how the fissure vein dipping to the east and striking north and south ran along the foot of Mt. Davidson. It was noted where the principle mines were located along the lode and specimens of ore from the Mackay School of Mines Museum were shown to show examples of both the original ore and the later ores found at depth. The party was much interested in the specimens of silver sulphide and gold that the original prospectors crushed and panned trying to save the gold and swore at the blue stuff (silver sulphide) which clogged their riffles or remained in their pan and prevented their getting out the gold good and clean. They did not know it was silver.

An interesting point was noted that in spite of the millions produced from the mines in Virginia City proper, only one mine produced and paid more in dividends than it levied in assessments. At the south end of the lode in the Gold Hill section there were several mines that did this.

The mines reached a depth of about 3300 feet from the surface but are now flooded up to the 1700 foot level at which depth the Sutro Tunnel taps the lode. The mines are now not being worked except on the surface.

After the working out of large underground stopes and filling them with timber in the form of square sets, the pressure of the ground gradually reached a point where the ground failed and slowly closed up. This action has caused the entire surface at Virginia City to settle, and a distinct break is noted on the hillside back of Virginia City where the entire surface has slipped. The settlement is also noted in many of the buildings in Virginia City.

Lack of time prevented visiting more than one property and for this visit the large open pit of the Arizona Comstock was chosen. As the lode comes near the surface it spreads out like a funnel and at the surface the low grade ore at the Arizona Comstock propery is 1600 feet wide. This ore was previously too low grade to mine and only rich streaks were taken out. With the development of flotation it has become possible to mine and treat the entire body of ore. It is now being mined in a large glory hole with power shovels at the rate of 400 tons per day. At present 150,000 tons has been taken out, leaving an immense open pit. There still remains 500,000 tons of what is claimed to be workable ore.

After viewing Arizona Comstock pit the party returned to Reno by way of Silver City and Carson.

New York Mineralogical Club to Observe 50th Anniversary

The New York Mineralogical Club will observe its 50th anniversary in November of this year. This, the most active of the local clubs, has had a long career of which it may well be proud. On its rolls may be found the names of many well-known mineralogists, and many of its members have made notable contributions to the science, both through discoveries and through research. The history of the club is an excellent example of the desirable and the successful way in which the collector and the research man can co-operate to their mutual advantage. The anniversary will be celebrated by a banquet, after which there will be a few brief addresses summing up the club's history and its contributions. There will be a mention of some of the member for whom minerals and varieties have been named, and the progress made by the science in the last five decades will be shown by contrasting the essential data for a mineral species in 1886 with that considered essential today.

Bibliographical Notes

Common Minerals: A little reference booklet entitled COMMON MINERALS has recently been issued by W. Scott Lewis, 2500 N. Beachwood Dr., Hollywood, Calif. It is 17 pages in length, priced at 15c, and contains a summary of concise information on minerals. Quite a number of the booklets have already been distributed to local students.

Mr. Lewis is one of our members and advertisers and we take pleasure in recommending the booklet to our readers.

The Johns Gem Cutter: This is an interesting 17 page booklet with 19 very good illustrations describing a lapidary machine recently invented by Mr. Geo. McD. Johns, Sappington, Mo., an enthusiastic amateur gem cutter. Mr. Johns has devised a number of unique features that should appeal to all followers of the fascinating hobby of the cutting and polishing of gem stones. Further information regarding the booklet and machine may be obtained from The Johns Company, Sappington, Mo.

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A PEEK AT OUR MAIL

Lost Without It!

Waterloo, Iowa—Please renew my subscription to ROCKS and MINERALS. I certainly am lost without it and wish to take this opportunity to commend you on your fine work.—George S. Busby.

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Brooklyn, N. Y.—I am enclosing a money order for $1.50 as payment for another year's subscription to ROCKS and MINERALS; also a stamped self-addressed envelope for my card of membership in the Rocks and Minerals Association. I'm always on pins and needles before each issue arrives. So if you don't like to see one of your subscribers in pain, continue to send the magazine regularly to —Evelyn Glantz.

Rocks and Minerals vs. The World!

Leominster, Mass.—Am enclosing P. O. money order in the amount of $1.50 for which kindly renew my subscription to ROCKS and MINERALS for another year. I wouldn't miss a single number of this magazine for the world.—Henry G. Savage.

Wow, A Contribution!

New York, N. Y.—Will you kindly accept the enclosed check for $2.00 as my contribution to a whale of an Anniversary Number this September. I feel certain that if every subscriber will do the same he will be more than amply repaid by the pleasure and knowledge such an issue would give him. Wishing you an even greater success with ROCKS and MINERALS in the future than you have enjoyed in the past.—Harry C. Ruger.

Wow, Wow, Another!

Brooklyn, N. Y.—I noticed Mr. Doherty's fine article on page 112 of the July issue. Please accept the enclosed contribution of $7.50 as my share toward the cost of the 10th Anniversary Number of ROCKS and MINERALS.—John Rechholtz.

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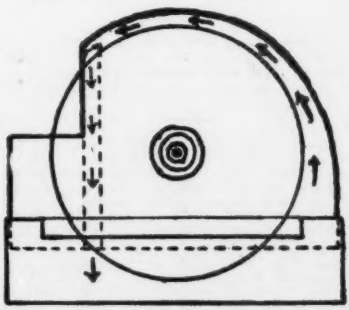
A SPLASH PAN

William Ralph Hoffa, 1616 N. Willington St., Philadelphia, sends the accompanying sketch of an interesting looking splash pan. The sketch is self explanatory. The device is in two parts, the reservoir and the cover. The cover sets in the reservoir, being aligned and held by one clip on each side. The sides are solid except for a slot for the arbor.

A unique feature of the rig is a gutter at the front lid of the cover, the gutter being drained through a square pipe downspout that carries the surplus water back to the reservoir. Mr. Hoffa says: "About two quarts of water is the right amount for the reservoir and I often work for two hours without having to replenish the water supply." This certainly indicates that the device is highly efficient as a controller of spray.



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